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THE WING FOLDING PATTERNS OF THE COLEOPTERA

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Scydmaenidæ (fig. 37), *Pselaphidæ* (fig. 38). Outer part of wing divided twice longitudinally as in the preceding type, but then folded many times transversely, the folds being alternately convex and concave, without the two successive concave folds characteristic of the Nitidulidæ. Anal lobe absent. These two families are obviously closely related, as they were placed by Leconte and Horn. Some recent workers have put most of the other Staphyliniform families between them.

Micropeplidæ (fig. 39). Outer part of wing folded many times transversely, but not longitudinally at all; Area C + H very narrow, almost rudimentary. Anal lobe absent as in the preceding type. This little group seems plainly related to the Pselaphidæ rather than the Staphylinidæ with which it is usually grouped, and represents the extreme of specialization in the recognized Staphyliniformia.

Phaenocephalidæ: Not available. Possibly a link between the Ptiliidæ and Nitidulidæ.

Discolomidæ (*Aphanocephalidæ*). *Discoloma vestita* (fig. 36) has two transverse folds and a somewhat irregular longitudinal crease, fading out before the second transverse fold. This sug-

gests the Liodidæ, but there are some discordances, especially the strong M_1 in the outer part of the wing. The absence of a fringe is unique in so small a form.

Ptiliidæ (*Trichopterygidæ*): As noted by Matthews there are two stages of reduction in the Ptiliid wing. In Nossidium (fig. 47) the wing is narrow-oval, with a considerable number of transverse folds. The first is convex, and there is enough left of the venation to show it is homologous with the fold formed by the first costo-apical and the principal fold in the Pselaphid series. Following this are two concave folds and then a regular alternation of convex and concave, definite on the costa, but somewhat broken up toward the inner margin; besides this there is the appearance of a longitudinal fold in the middle of the wing, but it is really made up of a mere series of crumples. The dorsal part of the wing has disappeared, and there is only a doubtful trace of area C + H.

In most of the family (Ptilium and Trichopteryx examined (fig. 48)), there are only four transverse folds, convex—concave —concave—convex; and the fringe is relatively much more developed.

This family seems definitely to belong to the Haplogastra, but shares characters of the Liodid-Pselaphid series (the simple convex transverse fold and obsolete pivot-system) and of the Nitidulidæ (the two successive concave folds following a convex one, which occur in no other families than these two). The genitalia throw no further light on their position.

HISTEROIDEA

I am applying this term to a series of forms without any very close union among themselves, but which can be excluded from the other three superfamilies of this series. Radial recurrent not extending before the cross-vein, which is well-developed; medial recurrent as a rule with a spur, long in Rhizophagus. Stigma more or less reduced, fairly well developed in Hister, but vanishing in the Nitidulid group of families. Anal lobe well set off or lost, irregular in outline or more or less definitely double in Sphaerites, Syntelia and most Histeridæ. Folding variable in detail but never with the regular two longitudinal folds of the second group of Staphyliniformia.

Histeridæ (figs. 40–42). A very characteristic family in the wing, as in other features. Hinge area reduced in size but wholly normal in function, the veins in the hinge region enormously thickened and the recurrents forming a heavy loop with the cross-vein r–m. Radial cell absent. Apical region with numerous traces of veins, R_2 and R_3 both being represented among others. M_4 and Cu perhaps also separate. Anals of principal group irregular, with broadened chitinizations and irregular grooves, the anal lobe normally more or less divided, and only the last part fully folded over. Area D not lengthened. Apical part of wing sometimes folded across twice, and normally with numerous longitudinal crumples. This family seems to link to the Hydrophilidæ on one side and more closely to the Lamellicornia on the other. I cannot see any direct connection with the Staphyliniformia.

Syntelidæ (figs. 43–46). Hinge part of wing less reduced than in the Histeridæ, the cross-vein and Mr being well distinguished from each other, and Mr with a basal spur. Stigma typically well developed, reduced in Sphærites; radial cell distinct in Sphærites, filled up with a rounded chitinous mass in Syntelia. Hinge region with a group of broad chitinizations, the more costal ones being also represented in the Nitidulidæ, and the more dorsal in the Histeridæ. Anals three, arranged the same way in Syntelia and Rhizophagus. Anal lobe highly characteristic, formed of two lobes which are separated by a slight crumple, but both fold over.

This is a curious family, with suggestions of each of the other groups of Haplogastra. The curious anal lobe would not be out of place in the Histeridæ, which the hinge also resembles, but the venation of Syntelia would connect the Hydrophilidæ and Lamellicornia, while Sphærites shows distinct leanings toward the Nitidulidæ and Syntelia to Rhizophagus. Superficially the family is equally transitional, with Syntelia leaning more to the Lamellicorns, and Sphaerites more to the Histeridæ and Nitidulidæ.

Nitidulidæ (figs. 50–54). This and the next two families are not very close to the preceding, though nearest perhaps to Sphærites, as Lameere has already noted. The costal thickening at the

hinge and the stigma have completely disappeared, though the secondary chitinizations at the hinge, which are so well developed in Syntelia and Sphærites, survive. The recurrents and cross-vein make a Syntelia-like loop. Most distinctive of the three families is the hinge arrangement; S and D are drawn out into long similar triangles pointing toward the center of the wing, and are folded together and then folded back on area C, which is also similar in shape, though longer as a rule. This peculiar form makes it possible to swing the apex of the wing almost directly back on the base without the use of the first costo-apical fold, and at first glance makes the folded wing look like a Liodid or Cryptophagid. The Nitidulidæ have an abundantly folded apical part of the wing, in which two things are characteristic;—the second and third costo-apical folds are both concave, instead of being alternately concave and convex, as in all other forms with large apical areas except the Ptiliidæ; and the concave median fold is much lower in the wing than usual, lying immediately above the median vein. The anal lobe is free. Variation in detail is enormous. I suspect that the primitive members of the family had short transverse folds, and short elytra, like Colopterus, and that long elytra are secondary, since the wings do not completely fill the space under them. In this case the transverse folding and well defined median fold of Colopterus is more primitive than the oblique costal folds and irregularly broken median fold more usual in the family (Phenolia). Nitidula is essentially like Phenolia, figured, but Camptodes and Amartus show somewhat more primitive conditions. Several of the early genera show Histerid-like traces of apical venation.

Rhizophagidæ (fig. 55). Hinge as in the Nitidulidæ, but apical part of the wing with the median fold central, and only a single transverse fold. Anal lobe free. Anals as in Syntelia.

Monotomidæ (figs. 56, 57). Similar, but anal fold sometimes sessile or lost. I have had no material of this family in really good condition, and cannot be sure how much of the apparent difference from the Rhizophagidae is merely due to imperfect folding.

LAMELLICORNIA

This is an entirely homogeneous group in both folding and venation, the principal difference being a little in the relative

size of the apical region. The distinction formerly used by Kolbe ('01) for the Passalidæ fails in our species, which has as large an apical region as many Lucanidæ. Anal lobe sessile (figs. 58–60), hinge erect, like the Synteliidæ rather than the Nitidulidæ, the area S sometimes broken up almost as in the Hydrophilus group; first anal area always well developed, and crossing the principal fold; with its convex above its concave fold. Apical region normally without a transverse fold (? if always). The venation is marked by numerous remnants of apical venation, R_2 and R_3 being especially conspicuous in Aphodius; and by the loop-like course of 3d A_1, which is faintly suggested in Sphærites but otherwise is limited to the Lamellicornia. The radial recurrent is not really present, the hook-like structure resembling it being really the filled-up radial cell; the medial recurrent is long and not connected with the radial.

BOSTRYCHIFORMIA

Costal chitinization stopping abruptly at the first hinge-fold, there being no trace of a stigma. Hinge folds reaching the costa separately, and with a few exceptions widely separated. The most striking exception is Endecatomus, which may possibly be a relict-form. Its venation is normal. Area B almost always markedly developed and forming the functional hinge, which is usually convex proximally and concave distally, and may either work with A, or cross the stump of M and work with the first anal area, or with smaller secondary folds. Wing usually without an apical fold. Median strahlader usually strongly developed, arising from an exceptionally long cross-vein; 1st r–m also developed in Artematopus and the Dascillid complex; and 4th A_2 in Dascillus with its close kin, and Cyphon. Anals in the principal group sometimes as many as six, the wedge-cell being open to the inner margin in Attagenus and few other Dermestidæ.

This is a very distinct type, though intergrading with the following through the Dermestidæ, and Rhipiceridæ-Lichadidæ. There are several dominant sub-types, the Dascillid, Cyphonid and Bostrychid; but only a plurality of the genera belong to either of these types, an unusually large proportion being oddities. I am not at all sure if the Buprestidæ should be placed here

or in the following series; they have always been associated with the Elateridæ, but are not over close (as Gahan and others have noted), and the hinge certainly approaches the Dascillid type in the few genera that have normally developed folding. Dermestes is also a joker. The venation associates it definitely enough with Dascillus, and the body characters with the other genera commonly called Dermestidæ, but the folding is entirely of the Serricorn-Clavicorn type, the hinge being not only at a definite point, but with a perceptibly chitinized costal margin, and with traces of a stigma. On the folding the genus would stand far better between the Lichadidæ and Ostomidæ. I have divided this series in three superfamilies according to the length of M, and the relation of area B to it and to the anal area, but the separation is superficial, and the groups are perhaps not pure. Sphindus and Corticaria, which have a modified Bostrychoid folding, might make a fourth sub-group, apparently related to the ancestor of the Ptinidæ; their distinctive feature is the small erect hinge-area.

A

Media extending well toward base of wing, with a more or less distinct bulla or deflection where area C mets it. Area B subordinate, and not extending below media, or occasionally large and working with A instead of with G, frequently with B not really developed, but with an indefinite extension of C to near the base of the wing.

Artematopus (figs. 62, 63). B very large, and C correspondingly short, the apex of B touching M at a slender place, and distorting it; A reversed, with the convex fold above the concave. First anal area indefinite, but of good size, reaching the margin; apex of wing with indefinite crumpling which tends to fall in two groups, possibly representing the two halves of the spiral roll of Cupes. First r–m fully developed, but with the part of Rs which attaches to it cut off from the rest by fold B.

A curious form, with a development of 1st r–m stronger than any other known Polyphagan, but in the folding of areas C and D distinctly associated with the more specialized Bostrychiformia.

Macropogon, Eurypogon: similar to Artematopus so far as studied; but with vein 1st r–m lost.

Dascillus (fig. 61). B represented by a slender fold, concave on the upper side and extending nearly to the base of the wing, partially separated from area C by some crumpling, but functioning as a unit with it; median fold slender; first anal fold practically lost; area S imperfectly developed, but with area D as large on the costa as in any form of the series. 1st r–m fine but traceable, extending from the small subtriangular radial cell across to M, which is long but weak and broken. The wing of Anorus is similar. A curious type, connecting the Bostrychoidea and Elateridae. The Schizopini, Sandalus and Rhipicera agree with merely generic differences. The remaining Rhipiceridæ and Buprestidæ are of very distinct types.

Dermestes (fig. 77). Similar to the preceding group except that the hinge is formed, and the costa slightly chitinized at that point. Vein 1st r–m not preserved, but venation otherwise practically as in Dascillus. Area B is not recognizable, but vein M tends to be interrupted in the same way as in Dascillus. A genus of uncertain relationship, perhaps derived from the ancestor of the Bostrychiformia.

B

Media extending less than half way to the base of the wing, crossed (except in Nosodendron) by a well-developed area B. Superficially this group would divide into a Helodid, a Dermestoid and a Bostrychid type, but the foldings intergrade completely. Some subapical folding is commonly present, but it never seems to take the form of a costo-apical convex and dorso-apical concave fold.

Nosodendron (fig. 64). This is possibly not related to the following genera, but separately reduced from something like Artematopus. Folding as in Artematopus, with a large area B working with area A, but media stopping short and not running between them; first anal fold narrower at the margin.

Anthrenus (fig. 65). Folding practically always incomplete, but of the general Nosodendron type. Area A not really developed, replaced by a small adjustment fold between B and G only, anal lobe freer than in Nosodendron.

Attagenus (fig. 68). Media longer than in the others of this sub-group, and area C correspondingly lengthened; area D distinctly narrowed to costa as in some Buprestidæ, but much further out and more oblique than in the Sphindidæ. Apical fold definite, concave to both costa and inner margin, and convex to apex. Anal lobe separated by a slight notch. Venation peculiar in having six free anals in the main group, as in the following genus and various Buprestidæ.

Megatoma (Dermestidæ) (fig. 67). Similar to Attagenus in venation, but with area C broken in two parts, and D broad at the costa; first anal area about as in Nosodendron; anal lobe sessile. A curious form. The folding is more Bostrychid than anything else but the venation connects it with Attagenus.

For winged specimens of *Thylodrias* (Hospitopterus) I am indebted to Mr. Barber. The folding is imperfect and peculiar (fig. 66) but the large reversed pivot is a Bostrychoid character, and the genus will fit near Anthrenus as well as anywhere.

Mastogenius (Good '25, fig. 49), to judge by the venation, is also a member of this group. In any case the reversed pivot (area B) is present, and the unsymmetrical recurrents will definitely throw it out of the Buprestidæ.

Eucinetus (fig. 69). Resembles the Cyphonidæ, but is a little more primitive in the small area G not reaching the margin, and peculiar in the two areas representing B, of which the smaller corresponds most closely to the usual one.

Cyphon (fig. 70), *Helodes, Scirtes.* Area B very large, and first anal area enormous, reaching the margin broadly, and divided by subordinate folds. Area C short, D broad on costa; apical fold as in Attagenus and Megatoma, but even more definite. A unique development.

Bostrychidæ (fig. 73). Area B large and normally transverse, but only indirectly working with the first anal area, being separated by a mass of small and variable folds; area C variable and sometimes divided, but always short; apex without a definite transverse fold; anal lobe sessile.

Several species have been looked at, but the differences are insignificant and the type very distinct. The closest thing, aside from the following forms, appears to be the Cyphonidæ, with

Eucinetus, which differ in the larger first anal area and the subapical fold, as well as in wing form, and especially in the transverse position of the short stub of M, and the short radial cell.

Lyctus (fig. 74) differs mainly in the free anal lobe.

In *Endecatomus* (fig. 75) the pivot is of the type found in the "normal" series, but is very oblique, and far out toward the apex. I suspect that as in some Buprestidæ this is a secondary effect of the migration out of the tip of the radial cell. The venation is normal Bostrychoid; on the other hand the genus is abnormal in other ways, and may be a relict comparable to Dermestes in the Anthrenid complex. The wing shows no connection with the Cisidæ.

Petalon combines the wing of the Bostrychidæ with body characters of the Dascyllidæ.

Ptinidæ. Folding was imperfect in the specimens of Ptinus examined, and it was not possible to make out if the subapical fold was as in Cyphon or as in Sphindus, but the apical area is large, with several folds. Area B is large, and functions as in the related forms, but barely crosses Mr and works with little crumples, rather than with G, which is well-developed. Areas C and H are apparently not separated (as occasionally also in the Bostrychidæ), and H narrows to a point at the inner margin; anal lobe free.

Sitodrepa (fig. 76). Similar; the apex with eight approximately radial folds, the last of them reaching the margin very close to the principal fold, almost cutting off area H from the margin. First costo-apical fold concave.

Ectrephidæ. Not examined, presumably intermediate between the Ptinidæ, which they resemble superficially, and the Gnostidæ, which have similar habits.

Gnostidæ. I have the opportunity to examine a specimen of Gnostus, through the courtesy of Dr. Wm. M. Mann. The venation and folding is substantially that of the Lyctidæ; the apical region large, but not as much folded as in the true Ptinidæ. Area A absent, B a large right triangle, extending from the costa to the tip of Mr which is far down toward the lower side of the cell and moderately long; radial cell a triangular chitinization, as in the Ptinidæ and Lyctidæ; apical folding confined to the

apex, forming a narrow chevron. Jugal fold narrow, with free tip, more like Ptinus than Lyctus. Area G well-marked, but not reaching the margin. The location of the genus here is beyond all question, and the family will take its place beside the Ectrephidæ, as a derivative of the Ptinidæ. There is nothing in other structures to contradict the reference, and its previous locations no doubt were due to its superficial likeness to the Paussidæ or to the Pselaphidæ.

C

Area D upright, distinctly narrowed to costa and at just about half the length of the wing; Mr longer than in the preceding forms, with B running along it to its tip, and with the concave fold above the convex, or broken up. First apical fold normal, being convex on costal half and concave on dorsal, and with further folds in the apex. Anal lobe free.

A distinct little group, but with obvious affinites to this series, and most closely to the Ptinidæ, apparently. The preservation of the costo-apical fold in this case is perhaps primitive.

Sphindus (fig. 71). Area B simple, concave before convex; C well marked.

Cordicaria (fig. 72). Area B broken up, its costal part with the convex fold before the concave as in other Bostrychiformia; C reduced.

NORMAL GROUP (DIVERSICORNIA)

In the following four superfamilies the pivot fold is normal in character; that is, the concave and convex folds meet at a point on the costa and the first costo-apical fold is at a distinct interval. In practically all forms $M_4 + Cu$ is undisturbed, the principal fold running along its upper side, but in the weevils, and to a slight extent in some Chrysomelidæ there has developed a crumpled region below Cu as in the Haplogastra, and Cu bends back in practically the same way. Such forms show no folding character to separate them from some of the Haplogastra. Stigma absent, or represented by a slight chitinization which is usually distant from the margin; costal edge rarely chitinized at hinge; anals in the principal group as many as six in early

forms, or even with traces of a larger number in some Lampyridæ and Buprestidæ. Body in general without primitive characters, the ocellus being present only in two or three Lymexylidæ, and the second pleurite fused with the third save in a few soft-bodied types, most of which seem to be degenerate rather than primitive.

I have divided this series into four superfamilies, on a close approximation to conventional lines. The Heteromera and Phytophaga seem to have absolutely nothing distinctive in the wings; in the case of the Serricornia and Clavicornia, I have used the length of area C, either taken alone, or including a secondary fold which may represent B. In most of the forms commonly treated as Serricornia this area or pair of areas reaches nearly to the base of the wing, and media is extended nearly to the base also; in most Clavicorns the area and vein stop near the middle of the wing. The Buprestidæ form a third main group, which may be appended to the Serricornia, but in this particular agrees more nearly with the Clavicornia; it is separable from both by the equal length of radial and median recurrents, and for the most part by the reversed area between C and D, which has the concave side facing C and convex side facing D and H, the exact opposite of the condition in the ordinary run of beetles. The folding is less stable than in most families, and may be reduced to a couple of crumples, with areas C and D completely fused, and H slender. It is also the only family of the series in which there are six anals in the principal group and the wedge-cell is open. It may perhaps not belong to this series at all, but to the foot of the Bostrychoidea. One would also like to attach the Lymexylidae to the Bostrychiformia, but there is nothing in the wing of any member of the family that would be out of place in the Serricornia or Heteromera. The frontal ocellus of a part of the genera appears to be the only Bostrychid character.

SERRICORNIA

Area C reaching nearly to base of wing, sometimes bisected by a weak crumple indicating B. Anal lobe sessile (except the Throscidæ). Adjustment of areas C and D highly variable, sometimes normal, sometimes by a group of folds, and sometimes

largely fused. Antennæ serrate or flabellate, etc., hardly ever clavate.

Lichadidæ (figs. 83, 84). B almost completely separated from C, but like it with the concave side up, and functionally continuous with it. C and D fused, save for minor crumples, S obliterated. Apical region without definite folds. Venation rather elater-like, but with the whole of 1st r–m traceable, much more oblique than in the Dascillus group. Base of 1st A distinct from cross-vein cu–a, as in the Elateridæ, and wedge-cell with the outer cross-vein somewhat oblique, but less so than the basal.

The family represents almost perfectly the point of origin of the Bostrychiformia, to which it should perhaps be transferred. It includes Zenoa and Callirhipis as well as Lichas.

Cebrionidæ (fig. 85). Six anals in the principal group, and wedge-cell closed by a cross-vein. Areas C and D fused, C extending to base without interposition of any area B. Cross-vein 1st r–m lost. Apical fold normal.

Elateridæ (fig. 86). B reduced to a slight crumple or lost, C extending to base of wing; C and D separated by a group of three small areas, the first corresponding to S, the second reversed and convex on all sides, the third with the concave side in front as in the Buprestidæ. As a result the area H seems to lie over C in the folded wing, instead of C over D and H as usual. Apical region with normal or somewhat irregular folds. Venation characterized by distinctness of 1st A and cross-vein cu–a at base, the long oblique radical cell with r–m attached near its middle, and the wedge cell closed by a transverse vein or open. There are a few genera associated with the Elateridæ in which all these characters fail, though the elaterid spring is present. The most striking case is Tharops, in which the base of 1st A and folding at apex of cell are exactly as in the Lampyridæ.

To judge by a very incomplete examination Brachypsectra may possibly be related to the Elateridæ or Lampyridæ. The pivot-fold is complete, and simple, unlike the genera which have been associated with it, and is followed by a deep chevron-like subapical fold, with a convex fold running to the costa, unlike any of the Dascillidæ or Helodidæ.

Lampyridæ (including *Telephoridæ* and *Lycidæ* (fig. 87). Exactly like the Elateridæ, except for the normal formation of

area S and the absence of an angle and spur at the base of 1st A, representing the separation of 1st A and cu–a. Subapical fold normal, convex at costa and concave at inner margin.

Languriidæ (fig. 88). Folding as in the Lampyridæ and Tharops, but with the apex crumpled rather than definitely folded. Venation as in Lampyridæ, etc., but with one branch of 2d A lost, as in the true Erotylidæ. This is no doubt on the Erotylid stem but in folding and venation is still a Serricorn.

Cucujus (fig. 89), *Passandra:* Fold A apparently completely lost, venation and folding otherwise normal for the Serricornia.

Lymexylidæ. Hylecoetus, similar to Languria, and like it with only four anals in the principal group. In Mellittomma area A is divided in two parts much as in Lichas; while in Euthysanius area S is practically eliminated, and C̄ fused with D as in Cebrio. Telegeusis (fig. 78) has only two folds of a somewhat ambiguous character, but is easily derivable from the Lymexylid type; Atractoceras has gone a stage farther, and lost its folding entirely. In wing characters this family appears plainly to belong to the Serricornia, and to lie between an early Elater type and the Languriidæ, though without any important difference from the Heteromera. It has no resemblance to either the Bostrychiformia or Micromalthus. The frontal ocellus, however, reappears just in those two groups.

Buprestidæ (figs. 79–82). An anomalous family, apparently separately derived from something near the ancestor of the Bostrychiformia. Areas A and B normally reduced to slender crumples, C stopping at about half the length of the wing, and frequently fused more or less completely with D, which is either open to the costa or reduced to a slender crumple. H always well marked and reaching the margin with its full width, very slender and nearly longitudinal in the more typical forms. Commonly with one chevron-like apical fold, but in Brachys and its kin with two, in several genera without any. Anal lobe highly variable, but never free. There is a regular reduction series in the family. In Eupristocerus and the Brachys group all folds are present and of normal size, but S is replaced by an area of reversed folding; Brachys is more advanced in venation, having lost the radial cell. Agrilus folds like Brachys, but the wing and

all the folds are slender and tend to be longitudinal. Acmaeodera and Buprestis have practically lost area s, and have only a single apical fold; Sternocera has lost all except a slender area H, and crumples. The completely chitinized dorsum of the abdomen (which is shared by a few Elateridæ) indicates an extremely primitive position.

CLAVICORNIA

Area C extending less than half way to base of wing, usually working with a well marked area B, which cuts across the end of the relatively short median recurrent. Apical folding more various than in the Serricornia, sometimes absent; venation more frequently reduced, the anals very commonly reduced to four; and anal lobe frequently more or less free. Antenna usually clavate. Dermestes may perhaps belong in this group, but is a link with the Bostrychiformia. A large proportion of forms have developed a wing-like chitinization crossing r–m, and stiffening area S, and a good many show some trace of the stigma as a small chitinization far from the costal margin.

Helotidæ (figs. 91, 92). About five apical folds, the first ones normal. Area B absent, A working directly with C, and media correspondingly long. Anal lobe partly free. Only four anals in principal group.

Ostomidæ (fig. 97. Similar, B more distinctly developed, anal lobe typically sessile. Anals various.

Cleridæ (figs. 93, 94). Apical folding variable in amount, the other characters as in the Ostomidæ. Altogether this is probably the most primitive of the Clavicorn families, and also (through the Necrobia group) leads up to the Dryopiformia. The genera Blatchleya and Onethes actually appear transitional in wing-folding, the first costo-apical fold starting from the costa practically at the pivot, but not actually working with it. The same condition appears in a few Melyridæ, though in the Melyridæ normally the pivot has become definitely associated with the costo-apical fold. There is no suggestion of special likeness to the Lampyrid-elater type.

Cucujidæ (fig. 90). The smaller genera associated with the Cucujidæ have wing characters far more like the three preceding

families; Laemophlaeus for instance is nearer to Necrobia than Clerus is.

Erotylidæ (fig. 95), *Phalacridæ* (fig. 96). Substantially as in the Ostomidæ. These families will separate from many clavicorns, but not from Laemophlaeus, by the fact that the median area is normal and not reversed. Anal lobe sessile in Erotylidæ, free in Phalacrus.

The *Thorictidæ* are apterous. They may be associated with the Phalacridæ.

These families make an almost perfectly homogeneous group. Dermestes approaches it in folds, but has a long media, and is generally associated with Bostrychiform genera. The Buprestidæ also connect with the Bostrychidæ, and are distinguished by the reversed area S and equal length of the radial and median recurrents, as already noted.

HETEROMERA

Folding varying from that of the Serricornia to that of the Clavicornia, without any distinctive group character. All folds are quite normal, and the area C tends as a whole to be long, more on the Serricorn order. (It is short in Monomma.) The wing-like chitization and rudimentary stigma noted under the Clavicornia are often distinct. There is nothing about the venation or folding to divide the series where Sharp and Muir, and Leng have done, but the Meloidæ stand out a little in venation. All possible links between the Meloidæ and the more normal Heteromera are found in the Rhipiphoridæ, as well as unfolded forms approaching the Stylopidæ, notably Rhipidius, while Myodites seems to belong to a variant type. The Trictenotomidæ and Rhysopaussidæ (Tretothorax) are normal.

PHYTOPHAGA

Folding in the Cerambycidæ (fig. 98) and most Chrysomelidæ exactly as in the normal Clavicornia, sometimes with and sometimes without an apical cross-fold, which is usually chevron-like. In some Chrysomelidæ (fig. 99) there begin to appear folds below Cu like those in the Haplogastra; and in the weevils, even the Anthribidæ (fig. 100), these have developed into a regular folded

area working with H as in that series. The only difference—which is not wholly constant—is in the relation to the vein Cu, as the convex fold along it tends to cross it obliquely, and not at the base, and the vein itself is more or less sinuous. Anal lobe sessile.

Proterrhinidæ apterous; Aglycyderidæ not seen.

DRYOPIFORMIA

I am using this name for the series of forms where the first costo-apical fold has migrated basad till it reaches the hinge, and then (almost always) the hinge has migrated down along the fold for a greater or less distance. The group may perhaps not be homogeneous. Off-hand there is a special temptation to separate the Melyridæ and Malachiidæ from the rest, and associate them with the Cleridæ, in some of which the costo-apical fold has almost reached the hinge. But none of the Cleridæ or their kin show the complex system of chitinizations in the hinge region and especially the chitinization of area D, which unites the Malachiidæ with the Coccinellidæ. The other groups all link together more or less closely. I make five subgroups, but the boundaries are more or less artificial.

In the Dryopiformia the costo-apical fold is less firmly set in than most of the folds of importance for classification, and I have had some trouble with specimens in which it had become partly unfolded or even had disappeared. In my single specimen of Monoedus the fold does not connect with the pivot, but the form is otherwise, both in body and wing, so close to the Colydiidæ that I think its position is in no doubt, especially as the hinge does not reach the costa but is connected to it by crumples. In all the other cases a second specimen has shown the fold in its proper position.

In most of this series cubitus remains undisturbed, and in short-winged types it turns almost directly across to the inner margin, to avoid crossing the principal fold. Frequently the tip of Cu is folded over, not so often by fold H_2 itself as by secondary folds working with areas G and H; occasionally this works back up the vein toward the point of junction with M, but only rarely reaches that point. In the final condition there is no real differ-

ence from the Haplogastra, and a few specialized forms must be placed in one series or the other on other characters. I have discussed most of these families here (in group C), but the Georyssidæ, on account of its chitinized pivot, with the Hydrophilidæ.

A

Anal lobe sessile; area H more or less narrowed to the inner margin, typically cut off from it by the meeting of the principal and first posterior folds, and working with a more or less extensive folded area below Cu, but without the second posterior fold being involved, as in the Coccinellidæ and their kin. The extremes of this type (Ptilodactyla and the Mycetophagidæ) seem widely separated, but they seem to be connected by insensible gradations through the Byrrhidæ and Heteroceridæ. On the other side the Mycetophagidæ are very close to such Colydiidæ as Ditoma, in the following group, and the separation is due to the apparent necessity of drawing a line somewhere.

Ptilodactylidæ (figs. 101–106, 114). This seems as good a name as any to indicate those genera formerly in the Dascillidæ which belong to this series. I have examined the following: Dæmon, Anchytarsus, Ptilodactyla, Odontonyx, Araeopus, Ectopria, Eubria, Placonycha, Chaetodactyla. In Eubria and Placonycha the principal area rests broadly on the inner margin, in most of the others the first posterior fold has met and crossed Cu, leading into a more or less developed folded area below Cu, which becomes very large in Placonycha. Dæmon and Anchytarsus have a fully developed anal venation, while the others are more or less reduced. On the other hand it is just the genera Eubria and Placonycha in which the pivot area is most reduced. The larva of Placonycha is said to be similar to Psephenus in the Dryopidæ. Mr. Böving also informs me that the larva of Ptilodactyla suggests that of the Dryopidæ and the Byrrhidæ. Araeopus seems to be a primitive form, perhaps transitional to the Cleridæ.

Chelonarium (figs. 107, 108) links the Ptilodactylidæ and Byrrhidæ.

Dryopidæ (figs. 112, 113). Areas C and D large and normal, B more or less foreshadowed but only appearing when the wing

is held in a certain position, so that a strain arises between the tip of M and the costal veins, in other positions with most of its area attached to C, as in the figure of Dryops (fig. 112). Fold A well marked; apex with a second fold, more or less unsymmetrically placed.

Heteroceridæ (fig. 115). Folding as in the Dryopidæ; anal venation reduced.

Mycetophagidæ (figs. 116, 117). Folding as in the Dryopidæ, but apparently with area B always insignificant or absent. Second apical fold absent.

Byrrhidæ (figs. 109–111). Similar to Eubriidæ, the areas C and D normally even more reduced. Area H typically cut off from inner margin; second apical fold close to apex of wing or absent. Areas B and G represented by small crumples, A obsolete. The difference between this family and the Nosodendridæ is parallel to that between the Eubriidæ and Cyphonidæ, and equally striking. There is at first glance a resemblance in venation between the Nosodendridæ and Byrrhidæ, but it does not extend to details, and may be the effect of similar body and wing-form. Limnichus is more generalized than the typical Byrrhids, with the pivot normal, and the principal area not cut off from the inner margin. It can be viewed as transitional to the Dryopidæ. Chelonarium is intermediate, with normal hinge, but with the first posterior fold crossing the cubital vein.

B

Anal lobe well set off, absent in the Malachiidæ. Area H primitively reaching the inner margin, but somewhat narrower, sometimes cut off from the margin by the first dorso-apical area (upright), but with the second (reversed) dorso-apical area never reaching in to Cu, and rarely even with the first dorso-apical area narrowed to the margin. Area B always developed and sometimes a principal fold of the wing, but unlike the Bostrychoids in which area B is similarly developed, without a functional first anal fold. This group intergrades imperceptibly with the next two through the Colydiidæ, and with the next one through the Endomychidæ. In these two families I have discussed individual genera where they would fall according to their folding, but it

would be premature to change their family reference without study of many more forms. It is interesting how the double chitinization at the anal angle, which appears on the two sides of an anal vein in the Endomychidæ, remains double in the Colydiidæ, and even the Lathridiidæ and Cisidæ, after all trace of the vein has gone. The Cryptophagidæ are a very different type from anything in this series, but as they are equally unlike anything else and have usually been grouped with Atomaria they are discussed in group C.

Melyridæ (figs. 122–124). Anal lobe free; area D well developed, and not chitinized. Area H reaching inner margin at a point if at all, B well marked, but not a principal fold. This family seems to be a link with the preceding group and to the Cleridæ, as the following attaches to the Coccinellidæ. Astylis appears aberrant in several points, but I have not seen any material of which I was sure the folds were undisturbed, and may not have interpreted it right.

Malachiidæ (figs. 125, 126). Area D very slender and heavily chitinized, and surrounded with other chitinized areas; B very large and dominating the folding of the wing, the costa curving back as it does in the Bostrychidæ. Folding in dorso-apical region more or less complex, with area H not completely cut off from the margin. No anal lobe. Plainly derived from the Melyridæ in folding, but correlated with the Coccinellidæ in venation. In Collops Cu runs transversely to avoid the principal fold, in Malachius it is more oblique and the principal fold crosses it not far from the base.

Endomychus (fig. 128). Essentially like the Melyridæ, but with a strong double chitinization at the apex of first A, and with the second dorso-apical fold, though somewhat vague, already strongly oblique in toward the apex of Cu.

Ditoma (*Colydiidæ*) (fig. 120). Similar to Endomychus, the anal lobe not so well set off; principal and first dorso-apical folds just meeting at the margin, as in the Cisoid group, but without the second apical fold of that group, and preserving the anal area. Many Colydiidæ are apterous or subapterous (fig. 119).

Monoedidæ (Adimeridæ) (fig. 118). Monoedus guttatus agrees substantially with Ditoma in wing-form and venation, and

has the characteristic double anal chitinization of this group, but in the specimen examined the first posterior fold does not meet the hinge. Whether this is an artifact or not the position of the genus can hardly be in doubt next to the Colydiidæ. In both these genera the anal lobe is hardly better set off than in the Mycetophagidæ.

C

Anal lobe always well developed and free; area C always well developed in forms with clean-cut folding, but in most Coccinellidæ lost in a general vagueness of all folds in the central part of the wing; D tending strongly to reduction in size, but usually perfectly distinct; H very small, not nearly reaching the inner margin, which is occupied by a large second reversed area, while the center of the wing is not reversed. Apex frequently of a single upright area, in that case with the upright area in the center of the wing tapering to a point, and the costal and dorsal reversed areas meeting at its tip. I believe this group is homogeneous except for the Georyssidæ and Cryptophagidæ, which are of quite uncertain position, but not wholly out of place here.

Aphorista (Endomychidæ) (fig. 127). Areas C and D well developed, and separated by a well-developed area S. Folds for the most part clean-cut, unlike the similar Coccinellidæ.

Mycetaeidæ (Endomychidæ ?) (fig. 135). Anal lobe rudimentary or absent. Area C long and slender, without a distinct area B at its end. Areas D and S small. Convex longitudinal fold from lower angle of area H not converging with the concave fold bounding area E, but running out to inner margin; a cross-fold across the apex of the wing cutting both these folds. *Atomaria* (fig. 136) is similar. I do not think these two forms are close either to the Endomychidæ or the Cryptophagidæ, but they come from the same general stock.

Derodontidæ (figs. 131–133). Areas A, B, C, D, S and H all fairly normal but forming a small group in the center of the wing; outer part of wing more or less definitely divided into two ranks of three areas each by longitudinal concave and convex folds, and a transverse fold, but less symmetrically than in Mycetaea and Atomaria; with a tendency for the reversed area of the outer rank and the dorsal area of the inner rank to fuse and

obliterate the outer dorsal area; and also with various and unstable smaller folds. Anal lobe small but well marked.

A very distinct family related to the Endomychidæ on one side and the Mycetaeidæ on the other, and probably not far from the ancestor of both. Laricobius hardly differs from Derodontus in folding, but has preserved more anal veins.

Coccinellidæ (figs. 129, 130, 134). Anal lobe free; central part of wing with vague bends rather than definite folds; among them area B is well marked, and at least the basal part of area C is distinct, but S, D and H are usually lost in the general curvature and crumpling. Postmedial part of wing with a triangular upright area between two reversed ones, as in the Endomychidæ, and *simple upright apex*. A rather distinct family type, and difficult to interpret on account of the vagueness of practically all the folding, but the large unfolded apex will distinguish it from most others at a glance. Coccidula is a little less vague, and areas D and S are distinct, but H is still lost in the vague outer folding. There is no difficulty in associating this family with the Endomychidæ, and even less when the venation is also considered (Forbes, '22, fig. 56).

Cryptophagidæ (fig. 137). Four folds converging at hinge, there being a concave one above the usual convex, and the outer part of the costa being swung back 180° on the base without folding under. Area H crossing Cu broadly as in the Haplogastra, and as in that group with the vein itself in a narrow unreversed strip. Anal lobe large, free, areas A and B present, C and D of relatively good size, H well marked off, but very small. Outer part of wing with a transverse fold cutting across three or four longitudinals.

A most anomalous family, thrown out of the Haplogastra, mainly by the preservation of five anals in the main group in some forms (Antherophagus). As the migration of folds on the costa has gone farther than on the inner margin it seems to belong to the general Dryopoid neighborhood, and the small size of areas D, S and H is suggestive of the Derodontidæ. The really fundamental difference from such genera as Atomaria and Laricobius is the appearance of a new longitudinal fold below the costal edge. In the Histeridæ there is a parallel develop-

ment of a new fold along the costa, which explains the concave character of the first costo-apical fold in that group, but it does not there involve the hinge. Telmatophilus and Henoticus do not differ from Antherophagus.

Catopochrotidæ (C. cremastogastri,—fig. 138). Identical in folding with the true Cryptophagidæ. The unique folding puts the position of this family (which was originally compared with the Cryptophagidæ) beyond all doubt.

D

Anal lobe lost; inner margin markedly notched at middle, both sides of area H converging to a point exactly at the notch; areas A and B insignificant or absent, D and S smallish, equal in size and directly superposed in the folded wing; outer part of wing relatively large, transversely folded at the middle, and with or without minor folds. Wing always markedly fringed, but the fringe varying somewhat in development, conspicuous on the costa in the Corylophidæ only.

This is an obviously homogeneous group, though its members have been widely separated on superficial characters. It is unmistakably derived from the Colydiidæ and Endomychidæ, many of the forms showing the characteristic double anal chitinization of these families. The venation is much reduced, but Cu avoids the folded areas, and Cerylon shows a stub of the median "Strahlader."

Cisidæ (figs. 139, 140). Double chitinization present, area C very small and working with more or less distinct crumples in the cell. Notch on inner margin strong.

Murmidiidæ (fig. 143). Similar to Cisidæ.

Lathridiidæ (fig. 141). Practically identical with Cisidæ, but with area C larger, and crumples in cell not obvious. Apex with a third transverse fold (? if always).

Cerylon (fig. 142). Area C exceptionally large; M_1 present as a well-developed stub; chitinization absent.

Corylophidæ (figs. 144, 145). Fringes present on outer half of costa as well as near hinge of costa and on inner margin; notch on inner margin less conspicuous than in the preceding forms, but well marked, and with area H extending to it in a point as

usual. Outer part of wing with some indefinite folding, but plainly of the same type as the preceding. This family plainly belongs here and not to the Staphyliniformia.

For clearness the facts here presented may be integrated into the following classification:*

Suborder ARCHOSTEMATA

34. Cupedidæ (Ommatidæ), 38. Micromalthidæ.

Suborder ADEPHAGA

Superfamily *Geadephaga*: 1. Cicindelidæ, 2, 4. Carabidæ (with Omophron), Paussidæ.

Superfamily *Hydradephaga*: *A*: 6. Bidessus, Hygrobiidæ, 5. Haliplidæ.

B: 6. Dytiscidæ (except Bidessus), 3. Amphizoidæ, 7. Gyrinidæ.

C: Cyathoceridæ, 8. Hydroscaphidæ, 27. Sphæriidæ, 13. Clambidæ.

Superfamily *Rhysodoidea*: 67. Rhysodidæ.

Suborder POLYPHAGA

Series *Haplogastra*

Superfamily *Palpicornia*: 8. Hydrophilidæ (except Octhebius group), 59, Georyssidæ (?).

Superfamily *Staphyliniformia*: A: 10. Brathinidæ, 20. Scaphidiidæ, 12. Silphidæ (s. str.), 16. Staphylinidæ (except Micropeplus), 9. Platypsyllidæ (?) 11. Leptinidæ (?).

B: 8, 12. Liodidæ (with Necrophilus, Prionochæta, Octhebius, etc.), Discolomidæ, 14. Scydmaenidæ, 17, 18, Pselaphidæ, 16. Micropeplus, 19. Ptiliidæ (?).

Superfamily *Histeroidea*: 21. Synteliidæ (with Sphaerites), 23. Histeridæ, 70. Rhizophagidæ, 71. Monotomidæ, 69. Nitidulidæ, Phaenocephalidæ (?), 19. Ptiliidæ (?).

Superfamily *Scarabaeoidea*: 99. Lucanidæ, 100. Passalidæ, 98. Trox, 97. Scarabaeidæ.

* The numbers refer to Leng's Catalogue.

Series *Bostrychiformia*

Superfamily *Dascilloidea*: Artematopus, 60. Macropogon, 60. Dascillus, 50. Rhipiceridæ (s. str.), 54. Schizopini, 64. Dermestes (?), 54. Buprestidæ (?).

Superfamily *Cyphonoidea*: 66, 64. Nosodendridæ (with Anthrenus, Thylodrias, etc.), 54. Mastogenius, 62. Cyphonidæ, 61. Eucinetidæ.

Superfamily *Bostrychoidea*: 92, 93. Bostrychidæ, 94. Lyctidæ, 91. Ptinidæ, Ectrephidæ (?), Gnostidæ, 95. Sphindidæ, 81. Corticaria.

Series *Diversicornia*

Superfamily *Serricornia*: 50. Lichadidæ (with Zenoa and Callirhipis), 48. Cebrionidæ, 49, 51, 52. Elateridæ (with Plastoceridæ, Eucnemidæ, etc.), 53. Throscidæ, 24, 25, 26, 27. Lampyridæ (s. l.), 73. Languriidæ, 31, 32. Lymexylidæ, 72. Cucujidæ (s. str.).

Superfamily *Clavicornia*: Helotidæ, 68. Ostomidæ, 29, 30. Cleridæ, 72. aberrant "Cucujidæ," 73. Erotylidæ, 84. Phalacridæ, Thorictidæ, 54. Buprestidæ (?), 89. Monommidæ (?).

Superfamily *Heteromera*: 87. Tenebrionidæ, Rhyscpaussidæ, 90. Melandryidæ, 86. Cistelidæ, 42. Pythidæ, 43. Pyrochroidæ, Trictenotomidæ, 37. Mordellidæ, 38. Rhipiphoridæ, 39. Meloidæ, (110). Stylopidæ, etc., 89. Monommidæ (?).

Superfamily *Phytophaga*: 101. Cerambycidæ (with Spondylidæ), 102. Chrysomelidæ, 103. Bruchidæ, 106. Anthribidæ, 107. Curculionidæ, 105. Belidæ, 104. Brentidæ, etc.; Aglycyderidæ (?), Proterrhinidæ (?).

Series *Dryopiformia*

Superfamily *Dryopoidea*: 60, 61. Ptilodactylidæ (with Eubria, etc.), 55, 57. Dryopidæ (with Psephenus and Elmis), 63. Chelonariidæ, 58. Heteroceridæ, 65. Byrrhidæ (except Nosodendron), 77. Mycetophagidæ.

Superfamily *Melyroidea*: 28. Melyridæ, 28. Malachiidæ.

Superfamily *Coccinelloidea*: 83. Endomychidæ, 78. Colydiidæ, 80. Monoedidæ, 82, 75. Mycetaeidæ (with Atomaria), 74. Dero-

dontidæ (with Laricobius), 85. Coccinellidæ, 75. Cryptophagidæ, Catopochrotidæ.

Superfamily *Cisoidea*: 96. Cisidæ, 81. Lathridiidæ, 79, 78. Murmidiidæ (with Cerylon), 15. Corylophidæ.

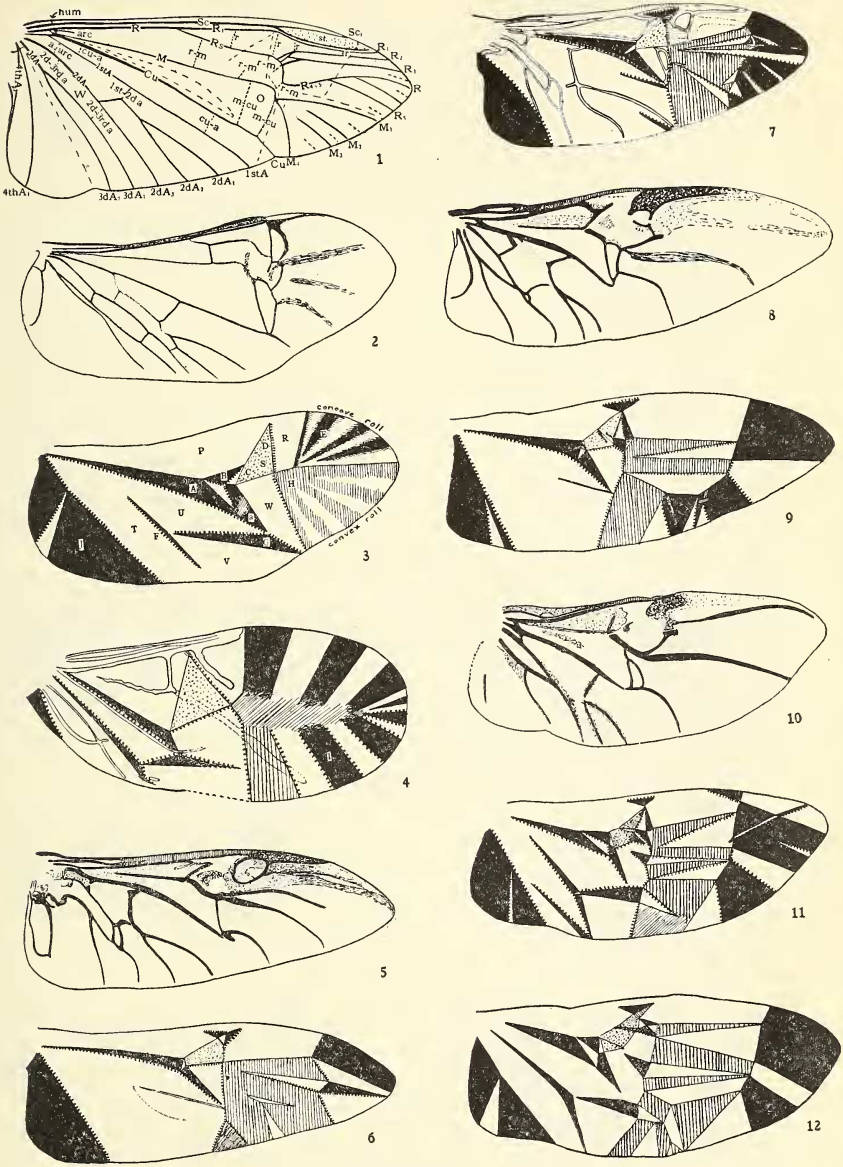
Families not available: Phaenocephalidae, Ectrephidæ, Aglycyderidæ.

Families with no known winged species: Platypsyllidæ, Leptinidæ, Thorictidæ, Proterrhinidæ.

EXPLANATION OF FIGURES

PLATE VII

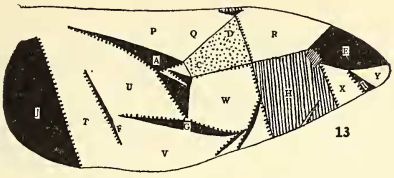
Figure 1. Hypothetical venation
Figure 2. *Cupes latreillei*, venation (Cupedidæ)
Figure 3. *Cupes latreillei*, folding (Cupedidæ)
Figure 4. *Micromalthus debilis*, venation and folding (Micromalthidæ)
Figure 5. *Cicindela sexguttata*, venation (Cicindelidæ)
Figure 6. *Cicindela sexguttata*, folding
Figure 7. *Calosoma peregrinatus* (Carabidæ)
Figure 8. *Brachinus fumans*, venation (Carabidæ)
Figure 9. *Brachinus fumans*, folding (Carabidæ)
Figure 10. *Paussus hova*, venation (Paussidæ)
Figure 11. *Paussus hova*, folding (Paussidæ)
Figure 12. *Paussus cervinus*, folding (Paussidæ)



WING FOLDING

PLATE VIII

Figure 13. *Dineutes* sp., folding (Gyrinidæ)
Figure 14. *Hygrobia tarda,* venation (Hygrobiidæ)
Figure 15. *Hygrobia tarda,* folding (Hygrobiidæ)
Figure 16. *Peltodytes* sp. (Haliplidæ)
Figure 17. *Bidessus affinis* (''Dytiscidæ'')
Figure 18. *Rhysodes exaratus* (Rhysodidæ)
Figure 19. *Cyathocerus horni* ?, venation (Cyathoceridæ)
Figure 20. *Cyathocerus horni* ?, folding
Figure 21. *Sphærius acaroides* (Sphæriidæ)
Figure 22. *Hydroscapha* sp. (Hydroscaphidæ)
Figure 23. *Calyptomeris alpestris* (Clambidæ)
Figure 24. *Clambus armadillus* (Clambidæ)



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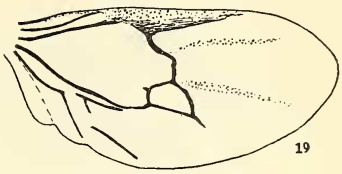
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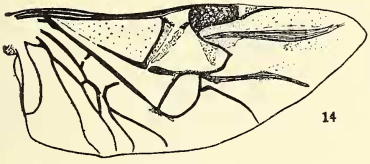
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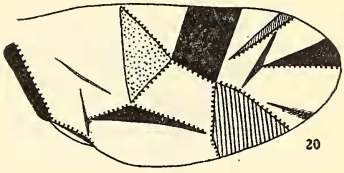
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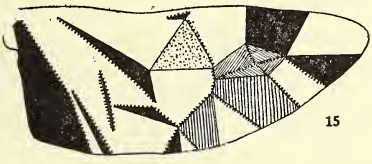
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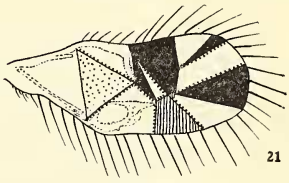
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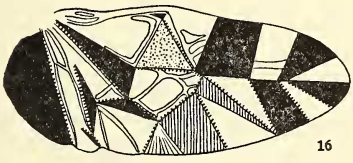
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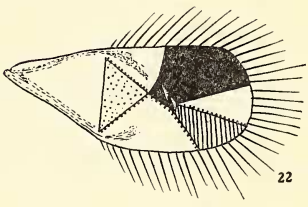
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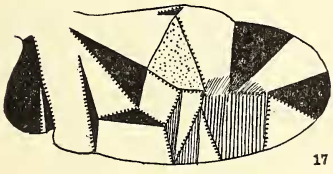
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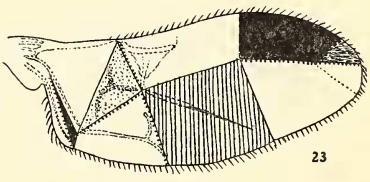
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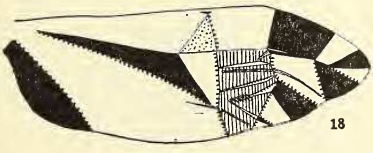
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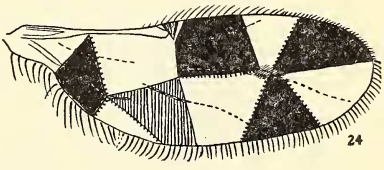
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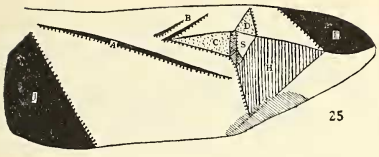
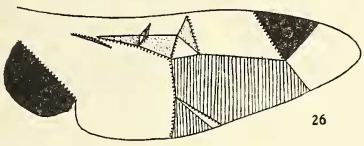
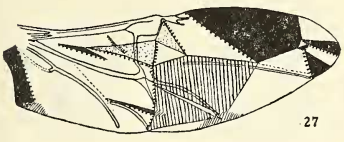
WING FOLDING

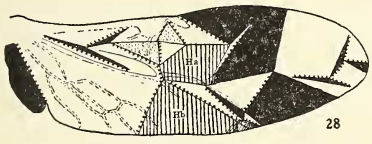
PLATE IX

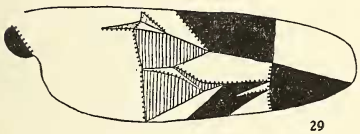
Figure 25. *Hydrocharis obtusatus* (Hydrophilidæ)
Figure 26. *Sphæridium scarabæoides* (Hydrophilidæ)
Figure 27. *Cercyon hæmorrhoidalis* (Hydrophilidæ)
Figure 28. *Helophorus lineatus* ? (Hydrophilidæ)
Figure 29. *Brathinus nitidus* (Brathinidæ)
Figure 30. *Scaphidium quadriguttatum* (Scaphidiidæ)
Figure 31. *Staphylinus* or *Creophilus* sp. (Staphylinidæ)
Figure 32. *Geodromicus plagiatus* (Staphylinidæ)
Figure 33. *Anthobium sorbi* (Staphylinidæ)
Figure 34. *Octhebius* sp. (Liodidæ)
Figure 35. *Anisotoma rubiginosa* (Liodidæ)
Figure 36. *Discoloma vestita* (Discolomidæ)

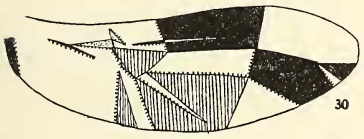


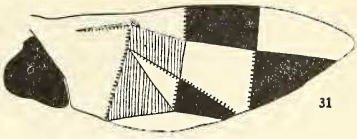


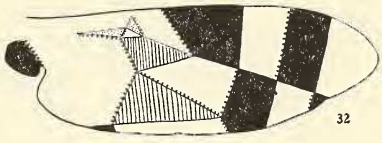


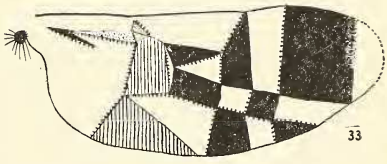


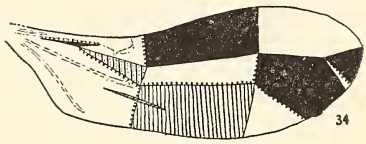


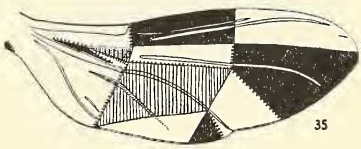


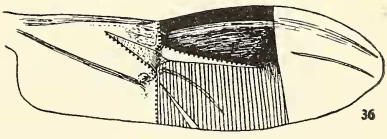












WING FOLDING

PLATE X

Figure 37. *Scydmaenus claviger* (Scydmaenidæ)
Figure 38. *Pilopius* sp. (Pselaphidæ)
Figure 39. *Micropeplus brunneus* (Micropeplidæ)
Figure 40. *Saprinus assimilis*, venation (Histeridæ)
Figure 41. *Saprinus lugens*, folding (Histeridæ)
Figure 42. *Hister depurator* (Histeridæ)
Figure 43. *Syntelia histeroides*, venation (Synteliidæ)
Figure 44. *Syntelia histeroides*, folding (Synteliidæ)
Figure 45. *Sphœrites glabratus*, venation (Synteliidæ)
Figure 46. *Sphœrites glabratus*, folding (Synteliidæ)
Figure 47. *Nossidium* sp. (Ptiliidæ)
Figure 48. *Acratrichis* (Trichopteryx) sp. (Ptiliidæ)

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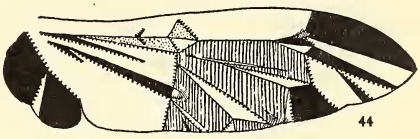
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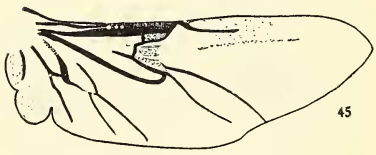
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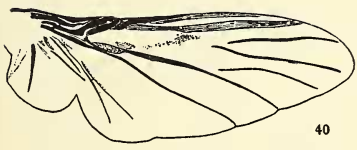
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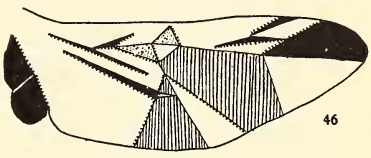
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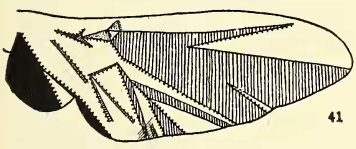
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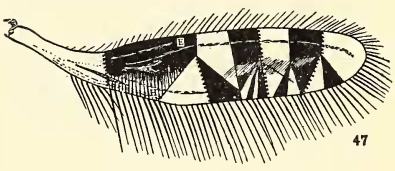
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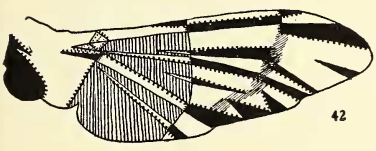
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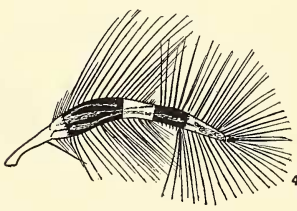
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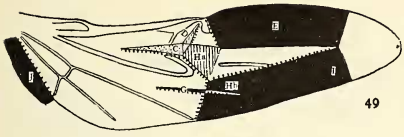
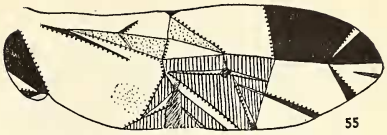
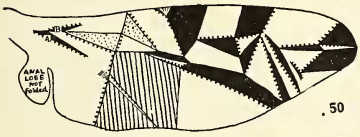
WING FOLDING

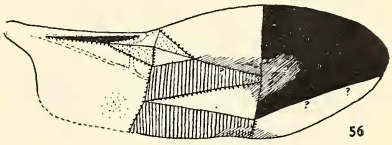
PLATE XI

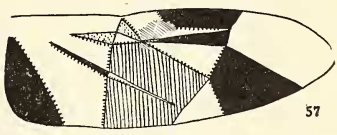
Figure 49. *Georyssus californicus* (Georyssidæ)
Figure 50. *Amartus rufipes* (Nitidulidæ)
Figure 51. *Colopterus truncatus* (Nitidulidæ)
Figure 52. *Camptodes vittatus* (Nitidulidæ)
Figure 53. *Phenolia grossa* (Nitidulidæ)
Figure 54. *Phenolia grossa*, detail of hinge
Figure 55. *Rhizophagus politus*, folding (Rhizophagidæ)
Figure 56. *Hesperobaenus abbreviatus* (Monotomidæ)
Figure 57. *Monotoma picipes* (Monotomidæ), incompletely worked out
Figure 58. *Lachnosterna* sp., venation (Scarabæidæ)
Figure 59. *Lachnosterna fusca*, folding (Scarabæidæ)
Figure 60. *Osmoderma*, folding (Scarabæidæ)

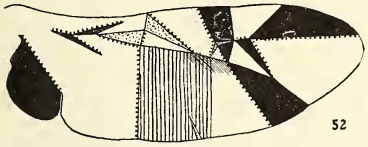


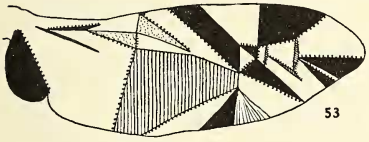


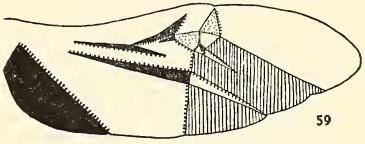


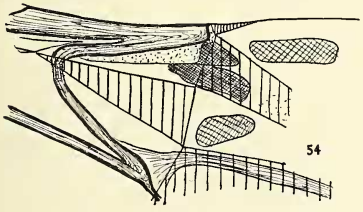


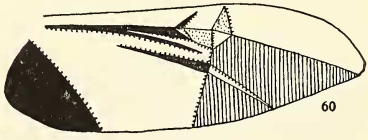








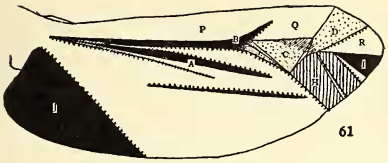




WING FOLDING

PLATE XII

Figure 61. *Dascillus davidsoni* (Dascillidæ)
Figure 62. *Artematopus* sp. from Peru, venation (Artematopidæ)
Figure 63. *Artematopus* sp. from Peru, folding (Artematopidæ)
Figure 64. *Nosodendron fasciculare* (Nosodendridæ)
Figure 65. *Anthrenus* sp. (''Dermestidæ'')
Figure 66. *Thylodrias contractus* (''Dermestidæ'')
Figure 67. *Megatoma undata* (''Dermestidæ'')
Figure 68. *Attagenus* sp. (''Dermestidæ'')
Figure 69. *Eucinetus meridionalis* (Eucinetidæ)
Figure 70. *Cyphon variabilis* (Cyphonidæ)
Figure 71. *Sphindus americanus* (Sphindidæ)
Figure 72. *Corticaria transversalis* (Sphindidæ ?)



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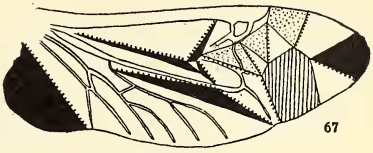
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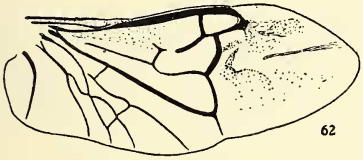
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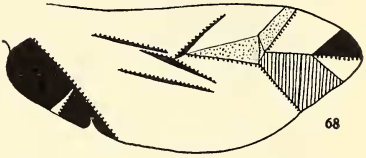
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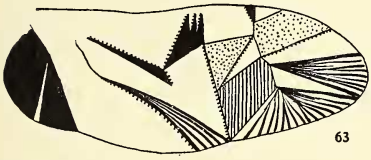
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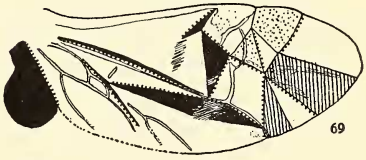
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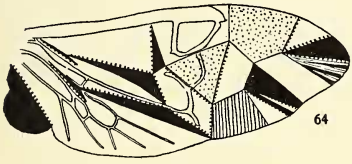
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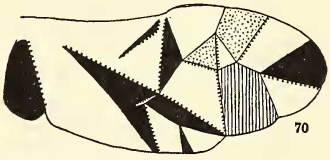
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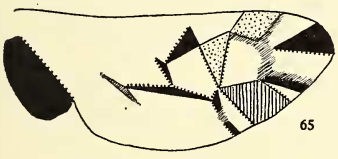
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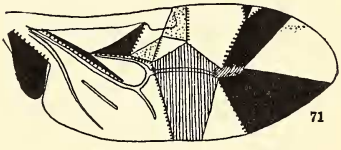
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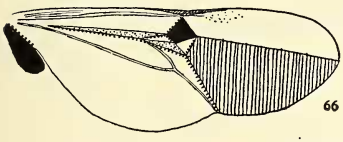
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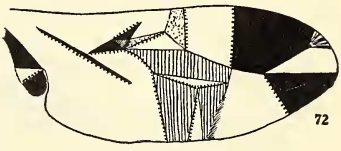
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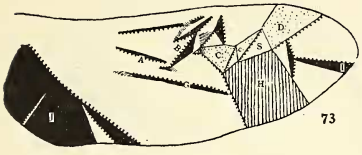
WING FOLDING

PLATE XIII

Figure 73. *Bostrychidæ,* undetermined species from Diamantina, Brazil
Figure 74. *Lyctus striatus* (Lyctidæ)
Figure 75. *Endecatomus rugosus* (family ?)
Figure 76. *Sitodrepa panicea* (Ptinidæ)
Figure 77. *Dermestes* sp. (Dermestidæ)
Figure 78. *Telegeusis debilis* (Telegeusidæ)
Figure 79. *Eupristocerus cogitans* (Buprestidæ). Left wing and apex of right wing.
Figure 80. *Sternocera* sp. (Buprestidæ). Apex of wing.
Figure 81. *Acmœodera* sp. (Buprestidæ)
Figure 82. *Brachys ovata* (Buprestidæ)
Figure 83. *Lichas subocellata,* venation (Lichadidæ)
Figure 84. *Lichas subocellata,* folding (Lichadidæ)



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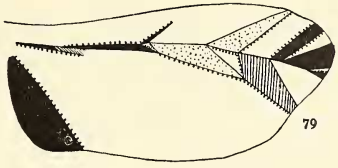

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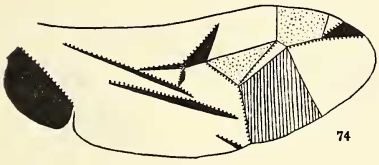

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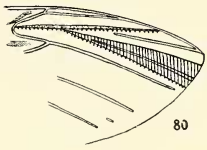

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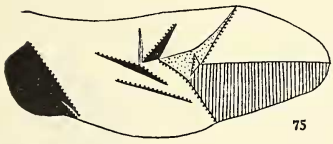

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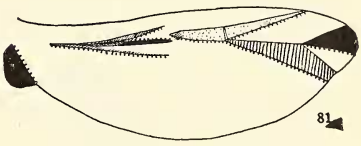

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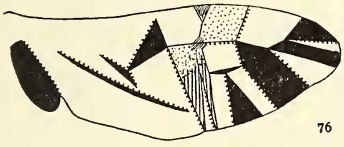

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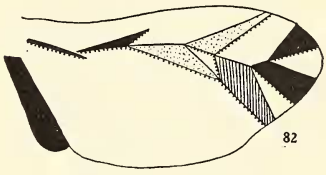

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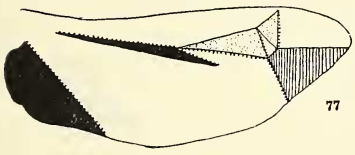

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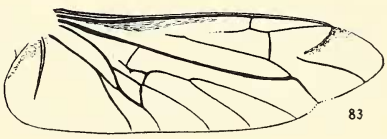

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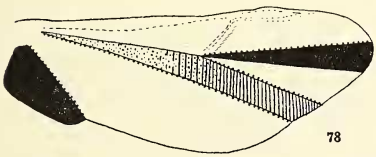

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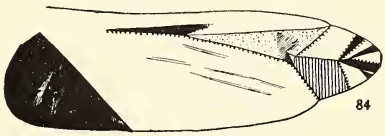

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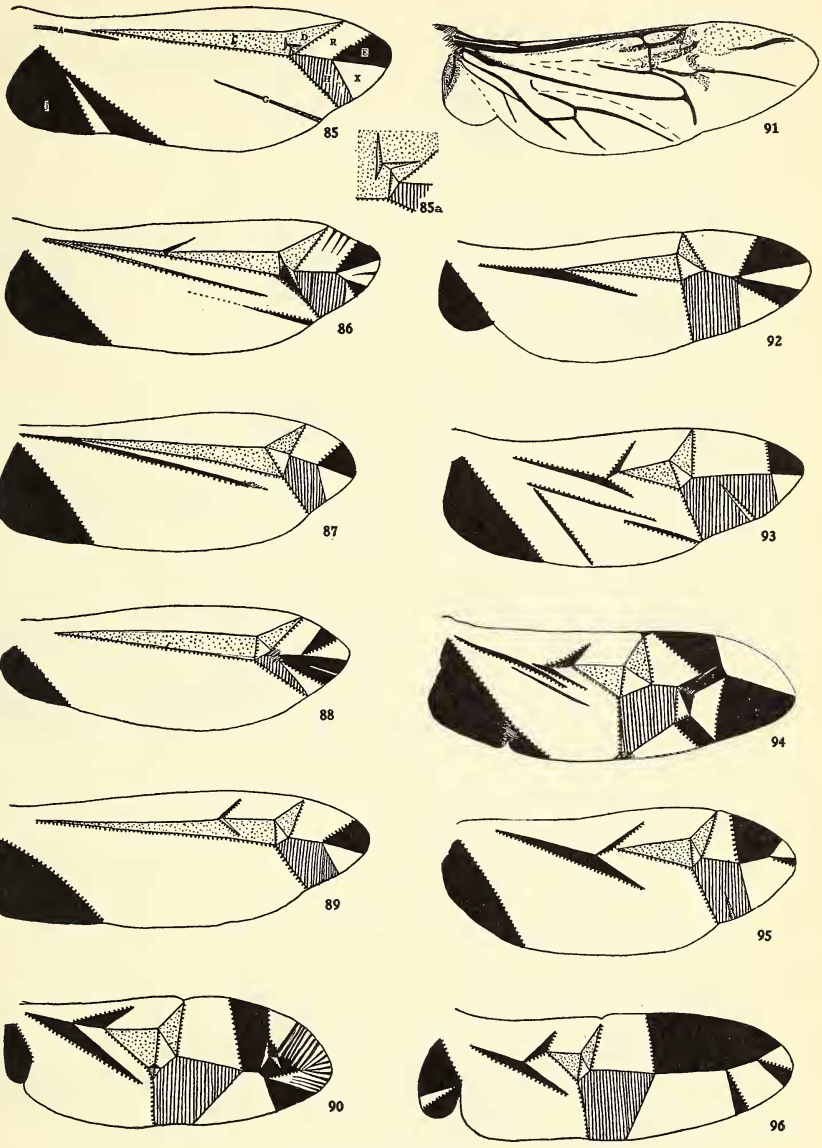
WING FOLDING

PLATE XIV

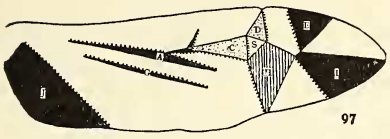
Figure 85. *Cebrio* sp., folding and detail of hinge (Cebrionidæ)
Figure 86. *Ludius* sp. (Elateridæ)
Figure 87. *Telephorus* sp. (Lampyridæ, Telephorinæ)
Figure 88. *Languria* (Aeropteroxys) *gracilis* (Languriidæ). In L. (L.) mozardi the apical folds are more numerous and radiate fan-like.
Figure 89. *Cucujus clavipes* (Cucujidæ)
Figure 90. *Laemophlaeus fasciatus* ("Cucujudæ")
Figure 91. *Helota vigorsi*, venation (Helotidæ)
Figure 92. *Helota vigorsi*, folding (Helotidæ)
Figure 93. *Clerus mutillarius* (Cleridæ)
Figure 94. *Necrobia rufipes* (Cleridæ)
Figure 95. *Megalodacne fasciata* (Erotylidæ)
Figure 96. *Phalacrus* sp. from Wyoming (Phalacridæ)



WING FOLDING

PLATE XV

Figure 97. *Trogosita virescens* (Ostomidæ)
Figure 98. *Cyllene* sp. (Cerambycidæ)
Figure 99. *Zeugophora kirbyi* (Chrysomelidæ)
Figure 100. *Platystoma labinus* (Anthribidæ)
Figure 101. *Dæmon fuscicollis,* venation (Ptilodactylidæ)
Figure 102. *Dæmon fuscicollis,* folding (Ptilodactylidæ)
Figure 103. *Anchytarsus bicolor* (Ptilodactylidæ)
Figure 104. *Ptilodactyla serricornis* (Ptilodactylidæ)
Figure 105. *Placonycha edwardsii* (Ptilodactylidæ ?)
Figure 106. *Eubria palustris* (Ptilodactylidæ)
Figure 107. *Chelonarium ornatum,* venation (Chelonariidæ)
Figure 108. *Chelonarium ornatum,* folding (Chelonariidæ)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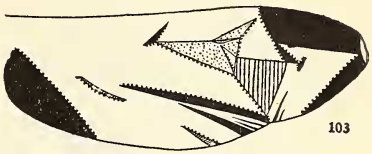
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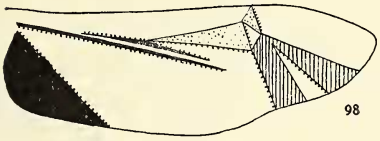
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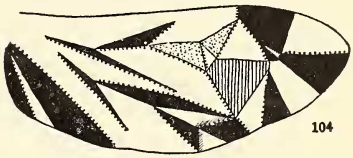
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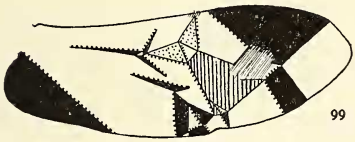
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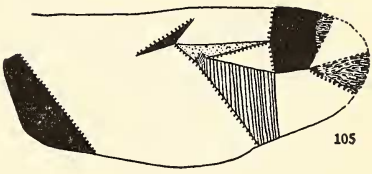
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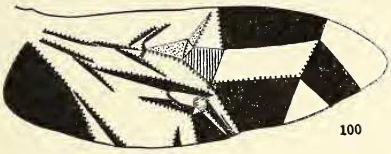
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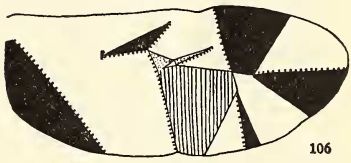
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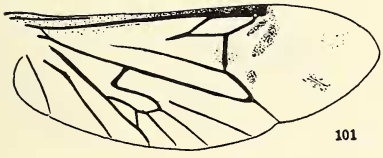
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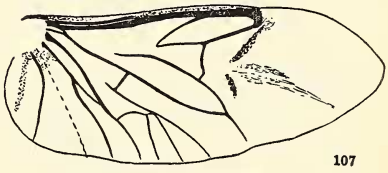
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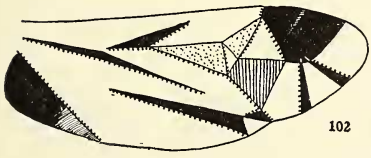
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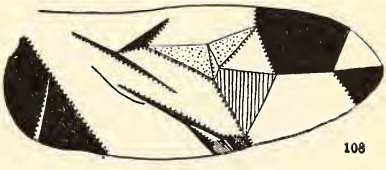
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WING FOLDING

PLATE XVI

Figure 109. *Cytilus* sp., venation (Byrrhidæ)
Figure 110. *Cytilus* sp., folding (Byrrhidæ)
Figure 111. *Limnichus* sp. (Byrrhidæ)
Figure 112. *Dryops lithophilus* (Dryopidæ)
Figure 113. *Psephenus lecontei* (Dryopidæ)
Figure 114. *Araeopus monachus* (family ?)
Figure 115. *Heterocerus guttatus* (Heteroceridæ)
Figure 116. *Mycetophagus punctatus* (Mycetophagidæ)
Figure 117. *Litargus bifasciatus* (Mycetophagidæ)
Figure 118. *Monoedus guttatus* (Monoedidæ)
Figure 119. *Coxelus pictus,* rudimentary wing (Colydiidæ)
Figure 120. *Ditoma quadriguttata* (Colydiidæ)
Figure 121. *Oxylaemus californicus* (Colydiidæ)

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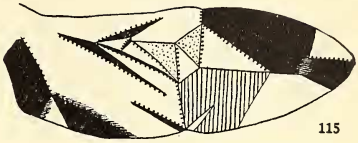
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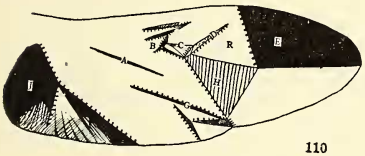

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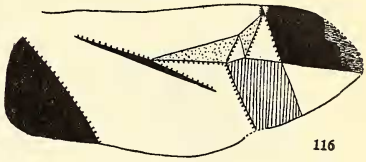
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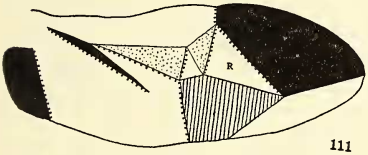

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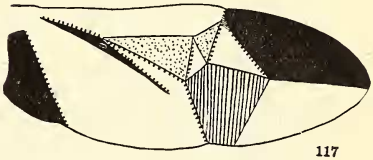
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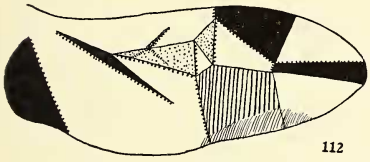
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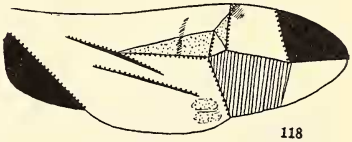
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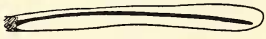
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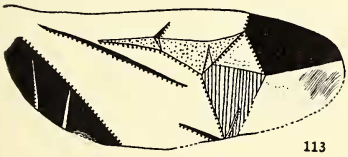
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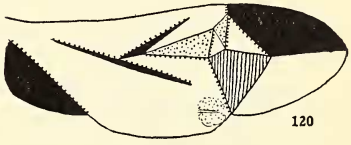
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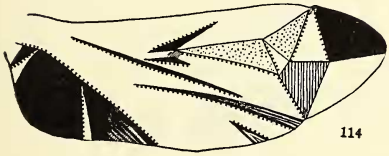
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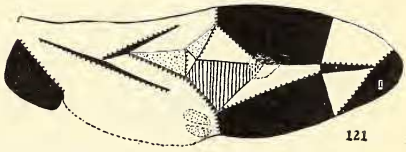
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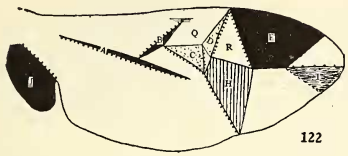
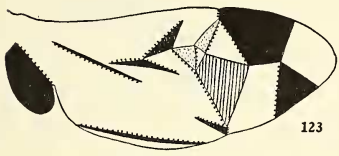
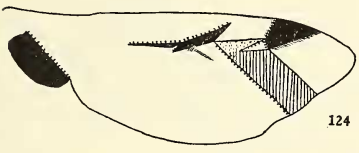
WING FOLDING

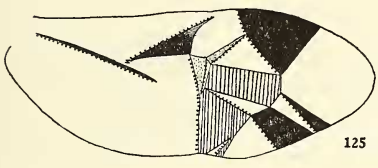
PLATE XVII

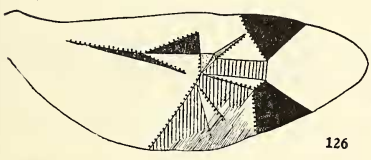
Figure 122. *Pristocelis antennatus* (Melyridæ)
Figure 123. *Listrus* sp. (Melyridæ)
Figure 124. *Astylis trifasciatus* (Melyridæ)
Figure 125. *Collops quadrimaculatus* (Malachiidæ)
Figure 126. *Malachius* sp. (Malachiidæ)
Figure 127. *Aphorista vittata* (Endomychidæ)
Figure 128. *Endomychus biguttatus* (Endomychidæ)
Figure 129. *Epilachna borealis* (Coccinellidæ)
Figure 130. *Anatis 15-punctata* (Coccinellidæ)
Figure 131. *Laricobius erichsoni* (Derodontidæ)
Figure 132. *Derodontus maculatus,* left wing (Derodontidæ)
Figure 133. Right wing of same specimen, showing variation in detail

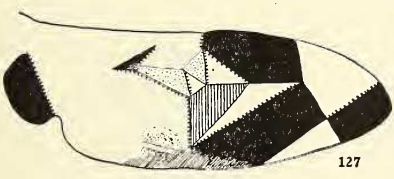


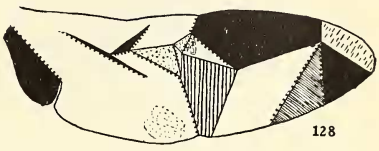


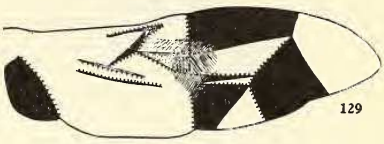


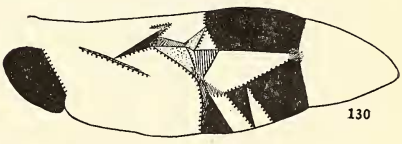


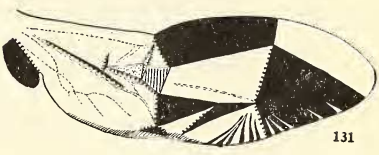


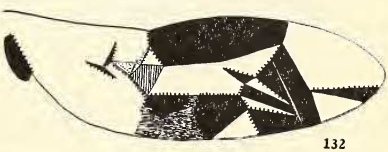


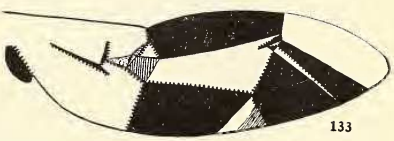








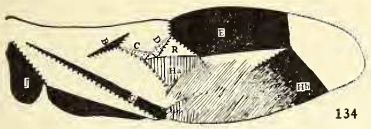




WING FOLDING

PLATE XVIII

Figure 134. *Coccidula scutellata* (Endomychidæ)
Figure 135. *Rhanis unicolor* (Mycetaeidæ)
Figure 136. *Atomaria ephippiata* (Mycetaeidæ)
Figure 137. *Antherophagus pallens* (Cryptophagidæ)
Figure 138. *Catopochrota crematogastri* (Catopochrotidæ)
Figure 139. *Cis boleti* (Cisidæ)
Figure 140. *Octotemnus laevis* (Cisidæ)
Figure 141. *Lathridius minutus* (Lathridiidæ)
Figure 142. *Cerylon histeroides* (family ?)
Figure 143. *Mychocerus depressus* (Murmidiidæ)
Figure 144. *Sericoderus lateralis* (Corylophidæ)
Figure 145. *Orthoperus scutellaris* (Corylophidæ)



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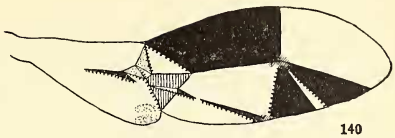
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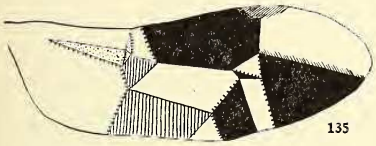
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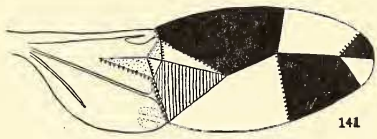
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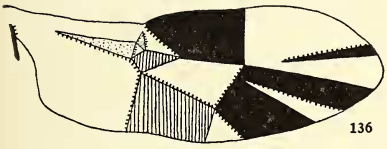
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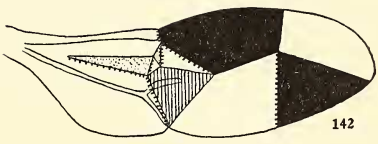
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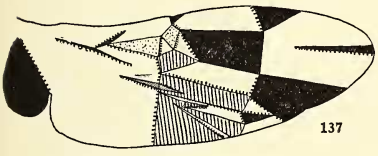
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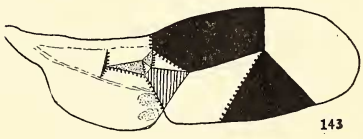
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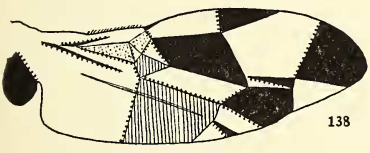
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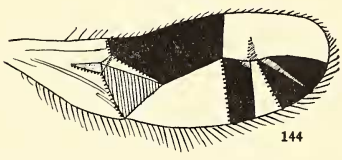
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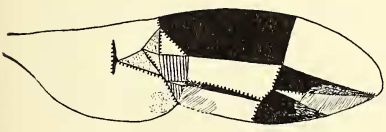
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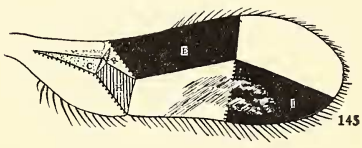

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WING FOLDING